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MODIS Validation, Data Merger and Other Activities Accomplished by the SIMBIOS Project: 2002-2003

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Chapter 6

Investigation of Ocean Color Atmospheric Correction Algorithms Using *In Situ* Measurements of Aerosol Optical Thickness : Application to MODIS

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6.1 INTRODUCTION

The SIMBIOS pool of sun photometers is composed of three types of instruments. The first is a sun/sky photometer that measures the solar irradiance and the sky radiance. The second is a shadow-band radiometer that measures diffuse and total sky radiances. The third is a Lidar, which measures vertical and horizontal distribution of aerosol backscatter, extinction, and optical depth. Pictures of the pool of instruments are presented in Figure 6.1.

The instruments are deployed by SIMBIOS or NASA Principal Investigators on cruises, and data are archived in SeaBASS (Werdell, 2003). The SIMBIOS Project deploys several sun photometers and radiometers composed of 14 hand-held MicroTops II, and three hand-held SIMBAD and SIMBADA radiometers. The Project has also contributed to the AERONET network by adding 14 stations in coastal regions or islands equipped with CIMEL sun photometers (Holben et al, Fargion et al, 2001). In addition, the Project reviewed and documented the description, characteristics and advantages of each instrument (Fargion et al., 2001). The protocols used for the calibration, operation and data analysis have been continuously reviewed, revisited and updated (Mueller et al., 2003, Porter et al., 2001) and (Knobelspiesse et al., 2003b). A user's guide and instructions are provided to help the Principal Investigators collect measurements according to protocol (Knobelspiesse et al., 2003a).

The Aerosol optical thickness (AOT) values are measured by each sun photometer at several wavelengths in the visible and near infrared. Data collected with hand-held sun photometers deployed at sea have been gathered and are available in the SeaBASS database (http: //seabass.gsfc.nasa.gov). CIMEL sun photometers supported by the SIMBIOS Project were added to the AERONET network and consequently the data are distributed through the AERONET database (http: //aeronet.gsfc.nasa.gov).

Uncertainty analyses were conducted to determine the accuracy of the aerosol retrieval from the hand-held sun photometers (Fargion and McClain, 2003). The analysis was based on the work of (Russell et al., 1993) and on the analysis conducted by the AERONET group on the CIMEL sun photometers (Holben et al., 1998,Eck et al., 1999). Efforts have been made to apply consistent protocols to transfer the calibration from a CIMEL sun photometer to any SIMBIOS sun photometer and to use a consistent algorithm to retrieve the aerosol optical thickness (Fargion et al., 2001). These efforts were conducted to ensure the same quality standards for the atmospheric data held in SeaBASS as the data provided by the AERONET network. Continuous efforts are now carried out to provide uncertainty analysis for the Angström Exponent as well.

Cross calibration analysis is performed for each sun photometer according to the protocols described in prior NASA Technical Memorandums (Fargion et al., 2001, Mueller et al., 2002). A calibration transfer is performed using the master CIMEL that is calibrated at Mauna Loa every 3 months. The interpolated calibration coefficients of the master CIMEL are provided by the AERONET Project. When only the first calibration of the master CIMEL is available, the calibration transfer is performed but the results are considered preliminary, and the campaigns of measurements are processed and submitted to SeaBASS along with a status flag "preliminary". When the final calibration of the master CIMEL is available, the final calibration transfer is performed. The campaigns of measurements are processed again and submitted to SeaBASS along with the status flag "final".

Quality control procedures are conducted to confirm that only the best data are submitted to SeaBASS. Figure 6.2 presents a flowchart of the sun photometer data and quality control analysis. Several plots are created from each AOT file to be used for qualitative Quality Control (QC). The plots include a map of data locations (to ensure coordinates are located where they should be), a history of calibration coefficients (to ensure they are not changing rapidly over the period of the data), a plot of AOT spectra (to ensure data roughly follow the Junge Law), and various histograms and other statistics (to ensure the data fall within reasonable bounds). QC is used as a tool to determine if there have been problems in the capture, calibration or processing of a set of data, but not as a rigid rule for acceptance or rejection of that data. Plots and statistical analyses created during QC for a file are submitted along with it to SeaBASS.